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ABSTRACT

This publication is designed to provide geography teachers with useful statistical information. It presents tables, maps, graphs, diagrams, and explanations of statistical data in 24 areas. The areas in which statistics are given are conversions, measurement, astronomy, time, daylight, twilight, latitude and longitude as distance, the relationship of latitude and area, physical comparisons, continental extremes, altitude effects, climate, motion, weather extremes, environmental limitations, urban area population, land usability, population characteristics, production and consumption of selected industrial commodities, energy, other economic and social measures, national economy measures, production rankings, and exports and imports. (AV)

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TOPICS IN GEOGRAPHY
Number 2

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STATISTICS
FOR
GEOGRAPHY TEACHERS

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National Council for Geographic Education

2

TOPICS IN GEOGRAPHY
Number 2

STATISTICS
FOR
GEOGRAPHY TEACHERS

National Council for Geographic Education
Illinois State University
Normal, Illinois 61761

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TOPICS IN GEOGRAPHY SERIES
Number 2

Statistics for Geography Teachers

Preface

The January issue of *The Journal of Geography* is designed to help teachers of geography find useful statistical information quickly. The need for this kind of information arose from discussions with educational geographers that pertained to teaching procedures. Mamie Anderzhon of Indiana State University, Pennsylvania, encouraged the project by providing data which she found particularly useful.

Geography students at Concordia Teachers College helped assemble the needed information. Particular credit is due Philip Gersmehl, now a graduate student in geography at The University of Georgia. He gathered and organized data, drew maps, diagrams, and graphs, wrote descriptive material, and checked information for accuracy. His work received financial support from the Nystrom Memorial Fund.

This project is intended to be an initial effort in providing statistical information to teachers of geography. Suggestions for improvement would be appreciated.

River Forest, Illinois
January, 1967

Herbert N. Gross

Editor, The Journal of Geography

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Conversions

Length

Nautical mile = 1.151 statute miles
Statute mile = 5280 ft. = 63360 in. = 1.609344 kilometers (1⅝)
Kilometer = 1000 meters = (⅝ mile)
Fathom = 6 ft. (10 ft. = 3 meters)
1° on great circle = (70 mi.)
1 hr. rotation = 15° = (1000 mi.)

Area

Square mile = 640 acres = 2⅝ sq. km.
Square meter = (10¾ sq. ft.)
Hectare = 2.471054 acres (2½)
Acre = 0.4047 hectares

Mass

Metric ton = 1000 kg. = (2200 lbs.)
Long ton = 2240 lbs. = 1.016 met. tons
Short ton = 2000 lbs. = .907 met. tons
Kilogram = (2.2 lbs.)

Capacity

Bushel = (35 litres)
Gallon = (3¾ litres)
Hectolitres/hectare = (1⅞ bushels/acre)
Cubic meter = 264 gallons
Freight ton = 40 cu. ft. = (1.1 cu. m.)
Register ton = 100 cu. ft.

Energy

Kilowatt = (1⅓ horsepower)
Metric ton of coal = .9 met. ton of coke = .5 met. ton of peat = 1.3 met. ton of petroleum = 1330 cu. m. of natural gas = 8000 kilowatt hours

Volume–Mass

Cubic foot of freshwater = 62.4 lbs.
Cubic foot of seawater = 64.6 lbs.
Cubic foot of ice = 55.4 lbs.
Displacement ton = 35 cu. ft. seawater

Pressure

Millibar = (¾ mm of Hg) = (.014515 lbs./sq. in.) = 0.1 decibar
Atmosphere = 1,013.250 millibars = 760 mm. of Hg = 29.92126 in. of Hg = 14.6960 lbs./sq. in.

Temperature

Absolute zero = −273.15°C = −459.67°F
°F = 9/5 °C + 32°
°C = 5/9 (°F − 32°)
Standard Temperature = 0°C = 273°K
Fresh water freezes at 32°F, salt at 28°F

Speed

Sound = (1117 ft/sec) = (760 mi/hr); in salt water (5000 ft/sec)
Light = 186,282 mi/sec
Mile per hour = 88 ft/min

Products

Wheat–Bushel = 60 lbs.
Corn–Bushel = 56 lbs.
Rice–Bushel = 42-45 lbs.
Cotton–Bale = 500 lbs.
Coffee–Bag = (133 lbs.)
Wood–Cord = 128 cu. ft.
Petroleum–Barrel = 42 gallons

Man's systems of measurement have evolved locally, and are deeply entrenched in local ways of life. This "cultural inertia" resists change, making conversion from one system to another an unwelcome necessity. The conversion units on this page are ones commonly used by the United Nations and the U.S. government, as found in their official publications. Figures in parentheses are approximations, quite adequate for most purposes. Many figures from this page are taken for granted on the following pages; others will be explained as the need arises.

Measurement

A map is a portable, simplified picture of the world or some portion of it. To be portable it must reduce the size of its subject, and to be read it must simplify. The question of how much area and how much detail leads us into the problem of measurement and scale. Scale is simply the mathematical expression of the relative size of the map and the area it represents. A large-scale map is a relatively large, detailed picture of an area. Because of its size and the amount of detail, it is usually restricted to small area. A map of a state to the same scale as a city map could cover acres. By putting the state map on a smaller scale, with less detail, it is possible to cover the larger area with the same size paper. A large-scale city map may be thought of as a magnifying glass held over the city portion of a state map.

There are four common ways to show scale. The most direct is the representative fraction, which states the number of units of reality that one unit on the map represents. Thus on a map bearing the representative fraction 1/63,360, one inch would represent 63,360 inches or one mile. The verbal statement of units (e.g. the number of miles to the inch) is the second common way, somewhat easier to comprehend. The third way is to show pictorially the relationship of inches to miles (or millimeters to kilometers, or inches to knots, etc.) by means of a linear scale of miles drawn somewhere on the map. The fourth is in a way the most abstract and most concrete of all. It uses a direct pictorial comparison in place of a mathematical statement, visually relating the map subject to a more familiar area. An example is the inset map showing Nigeria's place in Africa, giving an idea of its location and also a mental image of its approximate size. The use of one or more of these measures, ranging from a precise but abstract mathematical statement to an approximate but concrete visual image, depends upon the purpose of the individual map.

The approximate relation between the first two methods for a number of commonly needed scales is given in the following table:

Common Use	Representative Fraction	Verbal Statement
Blueprint	1/12	1 in. = 1 ft.
City block zoning	1/5,000	12 in. = 1 mi.
Geologic survey	1/24,000	2½ in. = 1 mi.
	1/62,500	1 in. = 1 mi.
County	1/200,000	1 in. = 3 mi.
State highway	1/750,000	1 in. = 12 mi.
U.S. wallmap	1/3,000,000	1 in. = 50 mi.
World wallmap	1/12,000,000	1 in. = 200 mi.
World deskmap	1/75,000,000	1 in. = 1200 mi.

Distance on a globe is found in much the same way. An 8 in. globe has a circumference of just slightly under 25 inches. Since the earth is 25,000 miles in circumference, this gives about 1,000 miles to the inch. Similarly, the scale on a 16 in. globe is 500 miles to the inch, on a 12 in., 666 miles. Distances are determined by stretching a string between points, and measuring the length of the string in inches.

Relative areas can also be computed, since the area of a square is the square of a side's length. Thus on an 8 in. globe 1 sq. in. = $1{,}000_{mi.} \times 1{,}000_{mi.}$ or 1,000,000 sq. mi. On a 16 in. globe 2 in. = 1,000 miles, so 1 million sq. mi. = $2_{in.} \times 2_{in.}$ or 4 sq. in. A million sq. mi. on a world desk map is less than a square inch. On the U.S. wallmap it requires 400 sq. in. or $20_{in.} \times 20_{in.}$, since 20 in. × 50 mi./in. = 1,000 mi. on a side.

The conversion from globe to map is not quite that simple, nor that accurate, since no map exists which does not distort either area or distance. However, for classroom use, the approximations given are close enough.

A few constants help bring abstract measurements within the child's experience, thus making expressions like production per acre and people per square mile meaningful. 1 acre = about a football field. 10 acres = about a city block. 1 sq. mi. = 640 acres.

Astronomy

Geography, the study of relationships in space, begins with the relationship of our earth with its neighbors. Most influential of these neighbors is the sun, for it is literally the source of all life on earth. Every child is taught that the sun is a big, hot, and faraway object, but how big, how far, and how hot is usually clouded in numbers beyond his comprehension. The term "astronomical" itself has been given the connotation of big-beyond-measurement. To help improve this situation, the table of astronomical measures includes a reduction of all measurements to their counterparts in a solar system with a 12" globe as the earth. It is only through analogies of this type that more accurate concepts of astronomical relationships can be imparted.

The other astronomical bodies have a wide variety of effects upon the earth. Most important, and most obvious, is the radiant energy given off by the sun. The principal benefits are light and heat for the earth's surface, but a number of other effects are also apparent. The interactions between solar radiation and the earth's magnetic field, upper atmosphere, and surface produce radiation belts, aurora phenomena, and long wave radiation from the earth itself. Other forms of radiation have no apparent source, seeming to come from beyond our solar system. How these all affect human life on earth is not yet clearly understood.

Another major effect is the result of gravitational attraction between astronomical bodies. This is responsible for orbit shapes and distances, as well as the familiar tides. The surface gravity of the sun is approximately 28 times that of the earth, while that of the moon is only 1/6 of the earth's. However, the relative closeness of the moon makes its tidal effect greater.

The third major effect is the least well understood. All plants and animals have "biological clocks" which regulate mating, migration, flowering, sleeping, and other actions. The day-night and seasonal rhythms are easily observed, but other cycles may be seen which relate to lunar phases, sunspot cycles, or causes or combinations of causes not even guessed.

Relationship	Actual measure	Earth a 12" globe
Earth diam:		
—equatorial	7,926.694 mi.	12 in.
—polar	7,900.004 mi.	11.96 in.
Sun diam.	866,000 mi.	109 ft.
Sun dist.	92,900,000 mi.	2.2 mi.
Moon diam.	2,160 mi.	3.3 in.
Moon dist.	238,862 mi.	30.2 ft.
Orbit speed of earth	66,600 mi. per hour	101 ft. per hour
Jet speed	600 mph	.9 sec./in
Light speed	186,282 mi./sec	23.5 ft./sec
Light year	5.88 tril. mi.	140,000 mi.
Height of		
—Mt. Everest	29,028 ft.	.01 in.
—Astronaut	140 mi.	.2 in.

For a 16" globe multiply last column by 1⅓.

A million earths would fit inside the sun. If the sun were a 12" globe, the earth would be a BB about 108 feet away.

It would take a jet traveling 600 mph about 17 days to get to the moon. The same jet would need over 17 years to reach the sun, and nearly half a million centuries to approach the nearest star.

Light needs only 1¼ seconds, 8⅓ minutes, and 4⅓ years for the same three journeys.

Time

Time is motion, the dimension of change. The constant flow of time is marked, though, by a number of environmental circumstances which divide it into clearly recognizable parts. For non-polar regions the most obvious of these circumstances is the day-night division. The regular procession of the seasons ranks second only to the day as a measure of time's flow. Both of these are astronomical phenomena, caused by the motion of the earth in space. The lunar phases give an astronomical measure between the day and the year.

When an exact quantitative determination of these periods is attempted, difficulties arise. Since the earth moves faster on its elliptical orbit at perihelion, the orbital position of the earth influences the length of the apparent day and the spacing of lunar phases. Thus there are two primary ways in which the regular astronomical periods can be measured. One is to observe rotation and revolution periods with relation to certain "fixed" stars (the first point in the constellation Aries, coinciding with the vernal equinox, is a common reference point). The computation of the time between successive crossings of a given meridian by a certain star gives the interval known as the sidereal day. The other method is to measure solar phenomena as they appear from the earth's surface. Since the earth moves along its orbit during a day, the sun requires about 4^m more than a star to again cross the meridian. The orbital speed causes variations in this difference, resulting in solar days which can vary by as much as 50^s. These fluctuations lead to civil reckonings, the arbitrary averages agreed upon for common use. Human necessity or convenience gives birth to a number of other time units, such as the second, semester, fiscal year, and so forth. The commonly accepted definitions of time units are given in the table.

The concept of time as motion has geographical importance for both longitude and latitude are sun-related and therefore time-related. Longitude is the distance equivalent of rotation time. It requires 24^h for the earth to turn all its 360° toward the sun. Each hour of rotation is thus equal to 15° on the earth's surface. Bands 15° wide of standard time are civil agreements. The time in a given zone is one hour earlier than the time in the band to the east and one hour later than that in the westward one. Establishing the band centered on the Greenwich meridian as the reference center gives a worldwide standard time system. Local preferences contribute to fluctuation of time zone (widths) borders.

Latitude and revolution are related by seasonal changes, which are best expressed graphically. The device for locating the apparent position of the sun over the earth for any date of its annual tropic-to-tropic migration is the analemma, found printed on many globes. For the 21st of each month, the following table gives a good approximation of the sun's apparent position.

J	23½°	N	
M	20°	N	J
A	11°	N	A
M	0°		S
F	11°	S	O
J	20°	S	N
	23½°	S	D

The greatest source of confusion in the standardized time concept is the 180° meridian. The necessity of its peculiar function is readily apparent—when a traveler moves eastward, he passes into bands of later clock time. If he were to circumnavigate the globe, he would pass through 24 such bands, giving him 24 hours later clock time when he returns to his starting place. A sudden 24 hour change to offset the 24 one-hour changes eliminates the contradiction. This is the function of the International Date Line (happily falling in the middle of an ocean), established by agreement as the opposite meridian to Greenwich.

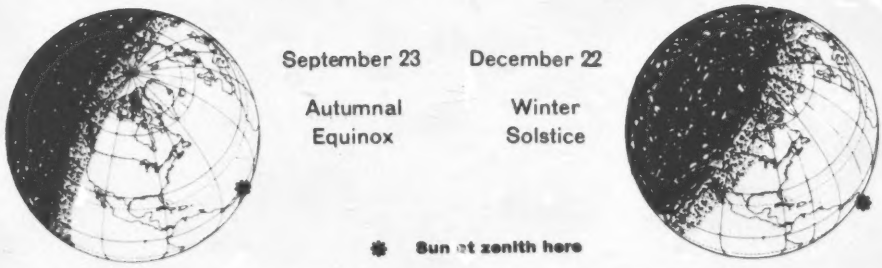
Unit	Sidereal	Solar	Lunar	Civil
Day	$23^h56^m04^s.091$	varies	24^h50^m	24 hours
Week	—	—	—	7 days
Month	$27^d07^h43^m11^s.5$	—	$29^d12^h44^m02^s.8$	28–31 days
Year	$365^d06^h09^m09^s.5$	$365^d05^h48^m46^s$	—	365–366 days
Hour	—	1/12th daylight	—	60 min.

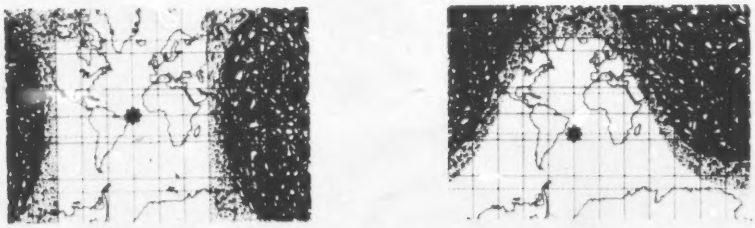
Daylight

Longest day		Lat.	Shortest day	
Hours	Minutes		Hours	Minutes
12	07	0°	12	07
12	11	1	12	04
12	15	2	12	00
12	18	3	11	57
12	22	4	11	53
12	25	5	11	50
12	29	6	11	46
12	32	7	11	43
12	36	8	11	39
12	39	9	11	36
12	43	10	11	33
12	47	11	11	29
12	50	12	11	25
12	54	13	11	21
12	58	14	11	18
13	02	15	11	14
13	05	16	11	10
13	09	17	11	07
13	13	18	11	03
13	17	19	10	59
13	21	20	10	55
13	25	21	10	51
13	29	22	10	47
13	33	23	10	43
13	37	24	10	39
13	42	25	10	35
13	47	26	10	30
13	51	27	10	26
13	56	28	10	22
14	00	29	10	17
14	05	30	10	12
14	10	31	10	08
14	15	32	10	03
14	20	33	9	58
14	26	34	9	53
14	31	35°	9	48
14	37	36	9	42
14	43	37	9	37
14	49	38	9	31
14	55	39	9	25
15	02	40	9	19
15	08	41	9	13
15	15	42	9	07
15	22	43	9	00
15	30	44	8	53
15	38	45	8	46
15	46	46	8	38
15	54	47	8	30
16	03	48	8	22
16	13	49	8	14
16	23	50	8	04
16	33	51	7	54
16	45	52	7	44
16	57	53	7	33
17	09	54	7	22
17	23	55	7	10
17	38	56	6	57
17	54	57	6	42
18	11	58	6	27
18	31	59	6	10
18	53	60	5	52
19	17	61	5	32
19	45	62	5	09
20	19	63	4	42
21	02	64	4	18
22	03	65	3	34
		66	2	46
		67	1	30
Never Sets		68		
		69		
		70	Never Rises	
		71–90		

The fact that the longest day and shortest day do not add up to 24 hours is due to the nature of the measurements. The sun is said to have risen when its upper limb, or top edge, appears above the horizon. If the calculations were made from the center of the sun's orb, the apparent discrepancy would disappear.

Twilight





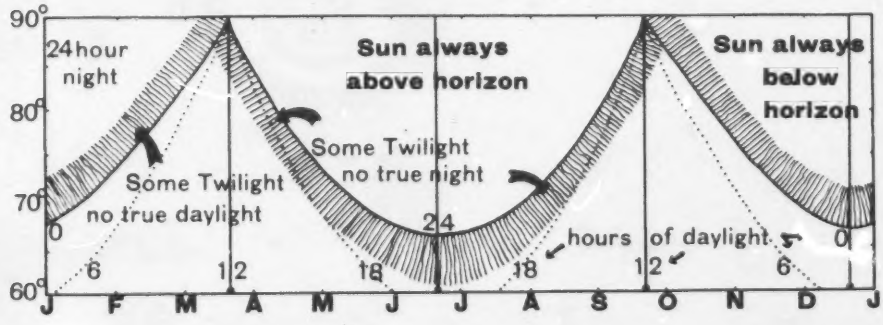
Giving exact statistics on daylight, twilight, and darkness is difficult because of the number of factors involved—principally the time of year and the latitude, though they are influenced also by refraction, leap years, and local conditions. Thus, for practical use, graphic methods give adequate estimates, providing a visual impression of the pattern without losing it in details. Since time on a rotating earth may be thought of as distance, drawing the line separating the light and dark hemispheres at any given time and counting the number of lighted 15° bands at a given latitude will yield the approximate number of daylight hours. Since twilight is the light reflected by the atmosphere beyond the lighted fringes, adding a band of appropriate width to the diagram facilitates the measurement of twilight time. Translating this information to a flat map clarifies the picture and makes measurement easier. The diagrams above show the light—nautical twilight—dark zones on the earth for two selected days. Others may easily be constructed following the same pattern.

Expressing the results of these measurements throughout the year gives a diagram like the one below. Tracing a spot at 75° gives the year-picture:

Jan. 1	Darkness
Feb. 1	Short twilight, no day
Mar. 1	About 7 hours daylight
Apr. 1	12-18 hours daylight
May-Aug.	24 hours day
Sept. 1	Some twilight, no night
Oct. 1	Less than 12 hours day
Nov. 1	Sun briefly seen at noon
Dec. 1	Darkness

The bands of civil twilight shown follow the lines of no twilight or day light and 24 hours twilight and daylight. The different heights of the twilight-reflective layer in the bulging atmosphere is averaged in the following table:

Twilight	Sun altitude	Effect
Civil	− 6°	Street lights on
Nautical	−12°	Bright stars seen
Astronomical	−18°	Stars all visible

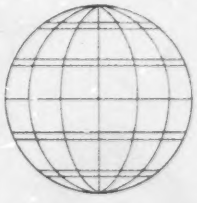


Latitude and Longitude as Distance

Lat.	Length of one degree of Lat.	Length of one degree of Long.	Lat.	Length of one degree of Lat.	Length of one degree of Long.	Lat.	Length of one degree of Lat.	Length of one degree of Long.
°			°			°		
0	68.703	69.172	30	68.878	59.955	60	69.229	34.674
1	68.704	69.161	31	68.889	59.345	61	69.241	33.622
2	68.704	69.129	32	68.900	58.716	62	69.251	32.560
3	68.705	69.077	33	68.911	58.070	63	69.261	31.488
4	68.707	69.004	34	68.922	57.407	64	69.270	30.406
5	68.709	68.910	35	68.934	56.725	65	69.280	29.314
6	68.711	68.795	36	68.945	56.027	66	69.290	28.215
7	68.714	68.660	37	68.957	55.311	67	69.298	27.105
8	68.717	68.503	38	68.968	54.578	68	69.307	25.988
9	68.721	68.325	39	68.980	53.829	69	69.316	24.862
10	68.724	68.128	40	68.933	53.063	70	69.324	23.729
11	68.729	67.909	41	69.005	52.280	71	69.331	22.589
12	68.734	67.670	42	69.017	51.482	72	69.339	21.441
13	68.739	67.410	43	69.029	50.668	73	69.346	20.287
14	68.744	67.130	44	69.041	49.839	74	69.353	19.126
15	68.750	66.830	45	69.054	48.994	75	69.359	17.959
16	68.757	66.509	46	69.066	48.135	76	69.365	16.788
17	68.763	66.168	47	69.078	47.260	77	69.371	15.611
18	68.770	65.807	48	69.090	46.372	78	69.376	14.428
19	68.777	65.427	49	69.103	45.468	79	69.381	13.242
20	68.785	65.026	50	69.114	44.551	80	69.385	12.051
21	68.793	64.605	51	69.127	43.620	81	69.389	10.857
22	68.801	64.165	52	69.139	42.676	82	69.393	9.659
23	68.810	63.705	53	69.151	41.719	83	69.396	8.458
24	68.819	63.227	54	69.162	40.748	84	69.399	7.255
25	68.828	62.729	55	69.174	39.765	85	69.402	6.049
26	68.837	62.211	56	69.185	38.770	86	69.403	4.842
27	68.847	61.675	57	69.197	37.763	87	69.405	3.633
28	68.857	61.121	58	69.208	36.745	88	69.406	2.422
29	68.868	60.547	59	69.219	35.715	89	69.407	1.211
30	68.878	59.955	60	69.229	34.674	90	69.407	0.000

The shortening of degree of longitude as one approaches the poles is a result of the meridians converging on the poles. The slight differences in the degree of latitude can be traced to the fact that the earth is not a perfect sphere. The following figures are also helpful measurements of our earth:

Distance around the equator = 360 degrees × 69.172 miles/degree
Distance around any parallel = 360 degrees × length of one degree in miles
Distance around earth at 60° = Exactly one-half distance around equator



Radius of earth through the poles = 3,950 miles
Radius of earth at the equator = 3,963.3 miles
Polar flattening therefore amounts to about 26.7 miles

Apparent speed of earth rotation at any latitude = 15 degrees/hour × the number of miles/degree. At 45°, therefore, the speed is 15 hour × 48.994 miles or about 735 miles/hour.

Curvature of the earth = about 9/10 of a foot per mile. A general formula for finding how many miles away the horizon is, that is, how far one can see, is to find the square root of the height of the observer's eye in feet and multiply by 1.317. For some sample heights this value is:

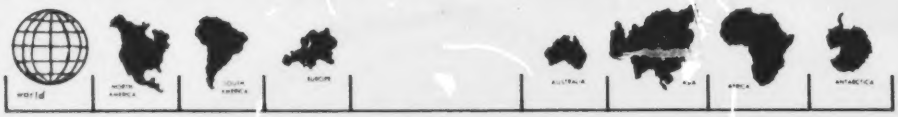
Observer's height	6 ft.	10 ft.	25 ft.	50 ft.	100 ft.	1000 ft.	1 mi.	50 mi.
Distance of horizon	3.2 mi.	4.2 mi.	6.6 mi.	9.3 mi.	13.2 mi.	41.6 mi.	95.5 mi.	677 mi.

The Relationship of Latitude and Area

Latitude in Degrees	Total Area		Northern Hemisphere		Southern Hemisphere	
	Percent of Earth Surface	Cumulative Percentage	Percent Land	Percent Water	Percent Land	Percent Water
0–5	8.68	8.68	21.4	78.6	24.1	75.9
5–10	8.62	17.30	24.3	75.7	23.1	76.9
10–15	8.48	25.78	23.5	76.5	20.4	79.6
15–20	8.30	34.08	29.2	70.8	23.6	76.4
20–25	8.04	42.12	34.8	65.2	24.6	75.4
25–30	7.72	49.84	40.4	59.6	21.6	78.4
30–35	7.36	57.20	42.3	57.7	15.8	84.2
35–40	6.92	64.12	43.2	56.8	6.6	93.4
40–45	6.44	70.56	48.8	51.2	3.6	96.4
45–50	5.92	76.48	56.2	43.8	2.5	97.5
50–55	5.33	81.81	59.3	40.7	1.5	98.5
55–60	4.71	86.52	55.0	45.0	0.1	99.9
60–65	4.05	90.57	69.2	31.2	0.3	99.7
65–70	3.36	93.93	71.3	28.7	20.5	79.5
70–75	2.64	96.57	34.5	65.5	61.4	38.6
75–80	1.90	98.47	22.9	77.1	89.3	10.7
80–85	1.15	99.62	12.8	85.2	100.0	
85–90	0.38	100.00		100.0	100.0	
0–90			39.3	60.7	19.1	80.9

The distribution of land and water on the face of the earth has an impact with widespread implications, especially noticeable in the climatic patterns of the world. The division of the Northern Hemisphere into cellular pressure systems, while the more uniform Southern has pressure bands, is a direct result of this uneven distribution. The presence or absence of certain climatic types, the tidal patterns, the effects of midlatitude continentality, the sea or land orientation of certain nations, and many other features are dependent upon land/water distributions. In this light, the world may be divided as in the diagram into a land hemisphere, with four-fifths of the world's area and 95 percent of its population, centered roughly on London, and a water hemisphere, centered near New Zealand. The early maritime orientation of England and Scandinavia takes on a new meaning when the world is viewed this way.

LAND



57.5	9.39	6.80	3.75	Area* in million square miles	2.98	17.0	11.5	5.50
—	16.3	11.8	6.5	% of land	5.2	29.5	20.0	9.6
3307	291	162	615	Population in millions	11	1851	304	—
—	8.8	4.9	18.6	% of pop.	.3	56.0	9.2	—
—	26	10	14	% of world coastline	7	24	11	8
—	26	9	12	% of world continental shelf	10	36	5	2
—	1/3	2/5	3/5	Below 600 ft.	1/3	1/4	1/7	—
—	1975	1750	975	Average elevation in feet	1075	2950	1975	—
—	1/5	1/6	1/15	Above 3000 ft.	1/50	1/3	1/4	—
—	20320	22834	18481	Highest	7316	29028	19340	16860
—	−282	−131	−92	Lowest	−39	−1296	−436	—

WATER

Atlantic	Indian	Pacific		Arctic	World†
31.8	28.4	63.8	Area in million square miles	5.4	139.4
22.8	20.3	45.8	% of water	3.9	93.1
1/20	1/30	1/50	Less than 600 ft.	—	1/15
12900	13000	14100	Average depth in feet	3900	12450
1/100	1/200	1/50	Over 20,000	—	1/100
27498	25344	36198	Deepest in ft.	17880	36198

* Excluding islands, 0.6 million square miles, about 1.1% of the world's land.
† Includes adjacent seas. Ocean figures are for basins only, excluding seas.

Comparisons

MAJOR SEAS

Rank	Sea	Area	Av. Depth
1	South China Sea	1,300	3,500
2	Caribbean Sea	1,063	8,172
3	Mediterranean Sea	967	4,878
4	Bering Sea	876	4,714
5	Gulf of Mexico	596	4,961
6	Sea of Okhotsk	590	2,749
7	Hudson Bay	476	420
8	Sea of Japan	389	4,429
9	Andaman Sea	308	2,854
10	North Sea	222	308

LARGEST ISLANDS

Rank	Island	Area
1	Greenland	840
2	New Guinea	317
3	Borneo	287
4	Madagascar	230
5	Baffin	184
6	Sumatra	183
7	Honshû	88
8	Great Britain	84
9	Ellesmere	82
10	Victoria	81

LARGEST LAKES

Rank	Lake	Area	Greatest Depth
1	Caspian Sea, *Europe-Asia*	143.6	3,264
2	Superior, *U.S.-Canada*	31.8	1,333
3	Victoria, *Africa*	26.8	265
4	Aral Sea, *U.S.S.R.*	25.3	223
5	Huron, *U.S.-Canada*	23.0	750
6	Michigan, *U.S.*	22.4	923
7	Tanganyika, *Africa*	12.7	4,710
8	Great Bear, *Canada*	12.3	450
9	Baykal, *U.S.S.R.*	11.8	5,315
10	Nyasa, *Africa*	11.4	2,226

LONGEST RIVERS

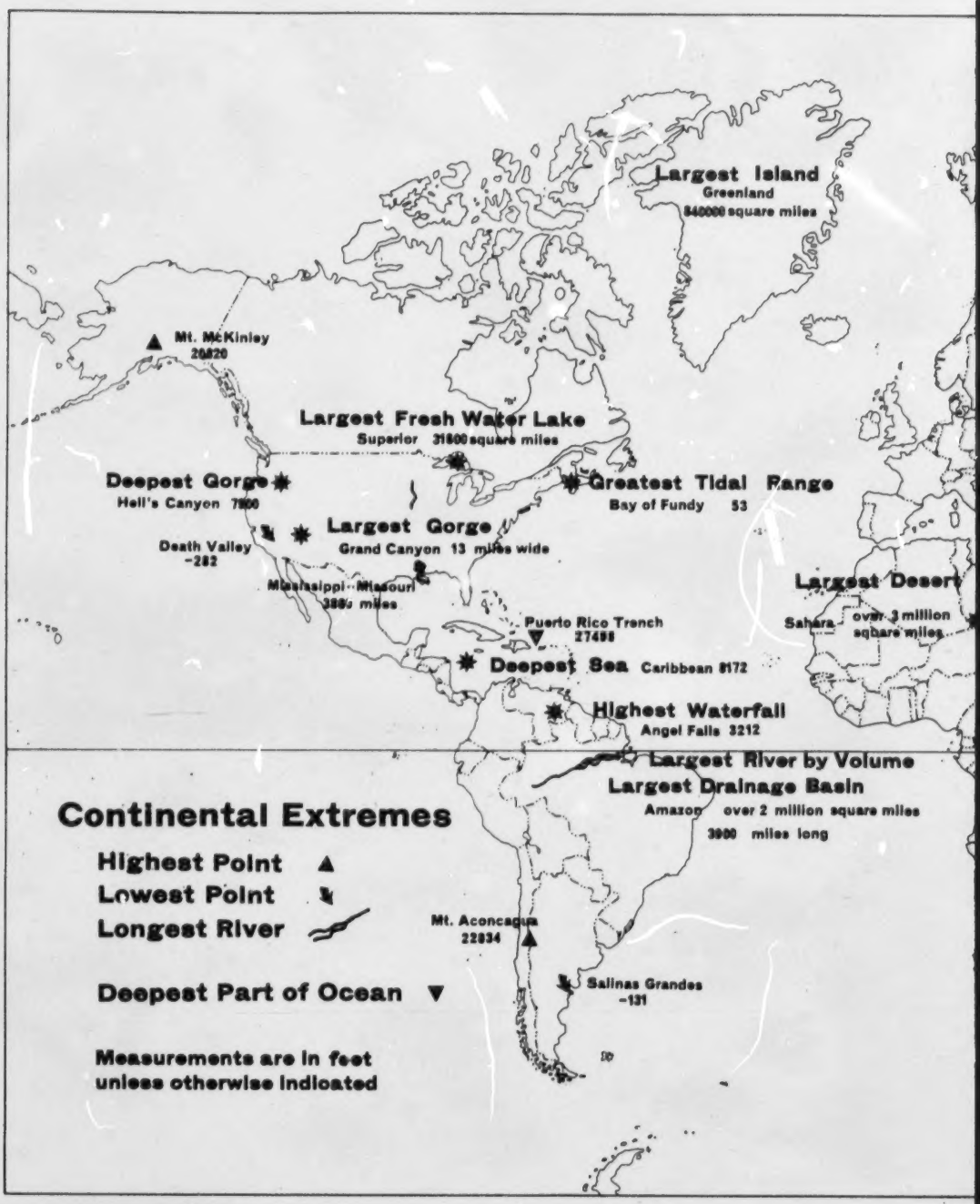
Rank	River	Length
1	Nile, *Africa*	4,145
2	Amazon, *South America*	3,900
3	Mississippi-Missouri, *U.S.*	3,860
4	Ob-Irtysh, *U.S.S.R.*	3,460
5	Yangtze, *China*	3,400
6	Huang, *China*	3,000
7	Congo, *Africa*	2,718
8	Amur, *Asia*	2,700
9	Lena, *U.S.S.R.*	2,680
10	Mackenzie-Peace, *Canada*	2,635

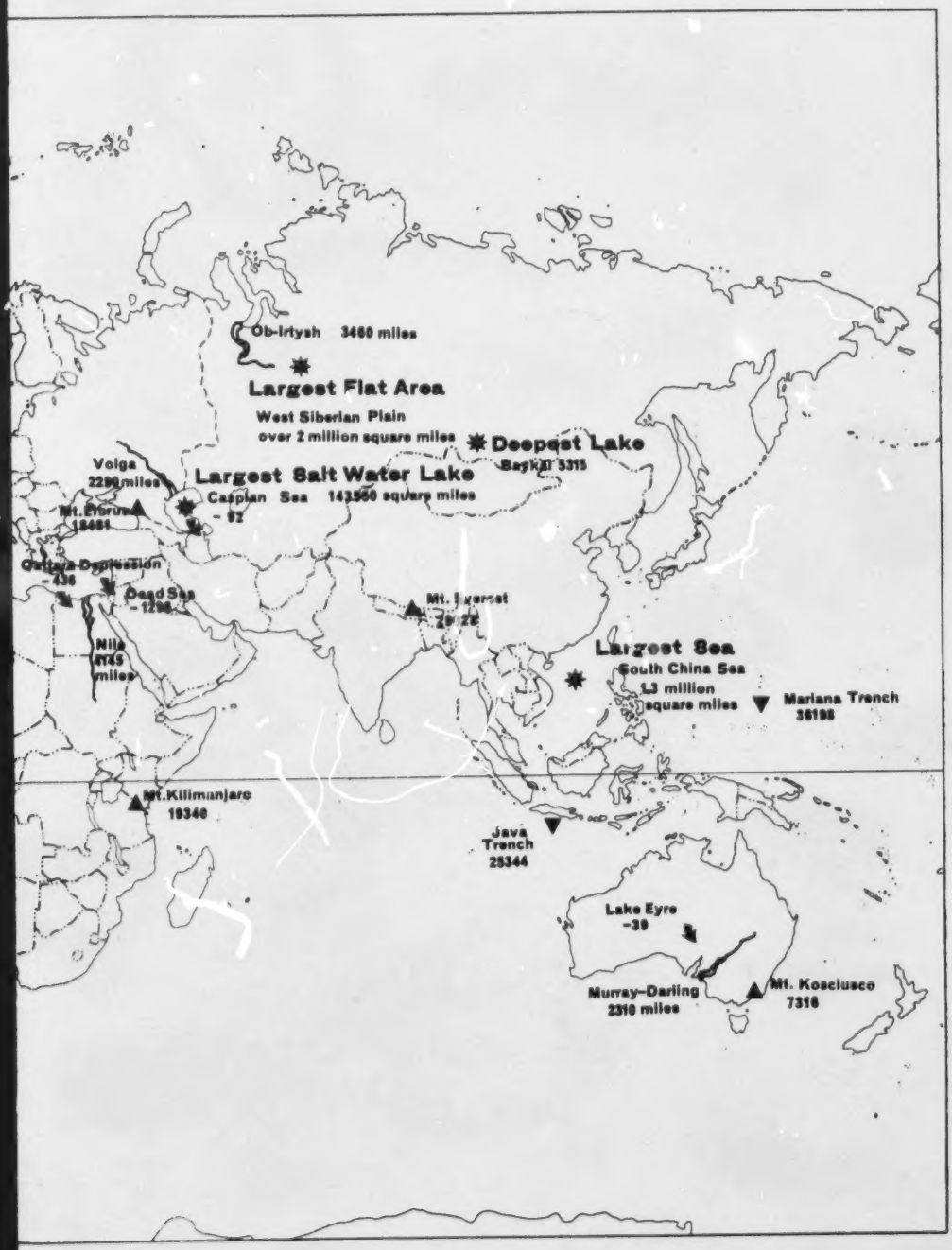
LARGEST RIVERS

Rank	River	Drainage Area	Rate of Flow
1	Amazon	2,231	7,500
2	Congo	1,550	1,400
3	Yangtze	750	770
4	Brahmaputra	361	700
5	Ganges	409	660
6	Yenisei	1,000	614
7	Mississippi	1,244	611
8	Orinoco	340	600
9	Lena	936	547
10	Parana	890	526

Any information which results in a better mental image of an area makes possible a better understanding of the human adjustments necessary for life there. Therefore, drainage, climate, landform, and relative location are made into systematic studies. Often, however, single facts can summarize much about a region. Consider how much is implied by the Amazon's flow, the amount of fresh water in the Great Lakes, or Europe's average elevation.

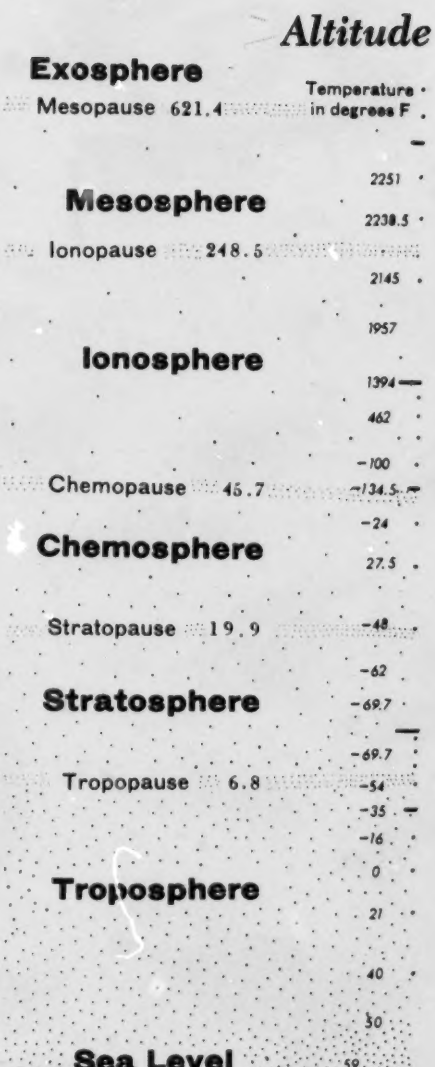
Areas are given in 1,000 square miles, lengths in miles, heights and depths in feet, and rate-of-flow in 1,000 cubic feet per second.


Largest Island
Greenland
840000 square miles
Mt. McKinley
20320
Largest Fresh Water Lake
Superior 31800 square miles
Deepest Gorge
Hell's Canyon 7900
Greatest Tidal Range
Bay of Fundy 53
Largest Gorge
Grand Canyon 13 miles wide
Death Valley
-282
Mississippi-Missouri
3895 miles
Largest Desert
Sahara
over 3 million
square miles
Puerto Rico Trench
27498
Deepest Sea
Caribbean 8172
Highest Waterfall
Angel Falls 3212
Largest River by Volume
Largest Drainage Basin
Amazon over 2 million square miles
3900 miles long
Continental Extremes
Highest Point
Lowest Point
Longest River
Deepest Part of Ocean
Measurements are in feet
unless otherwise indicated
Mt. Aconcagua
22834
Salinas Grandes
-131

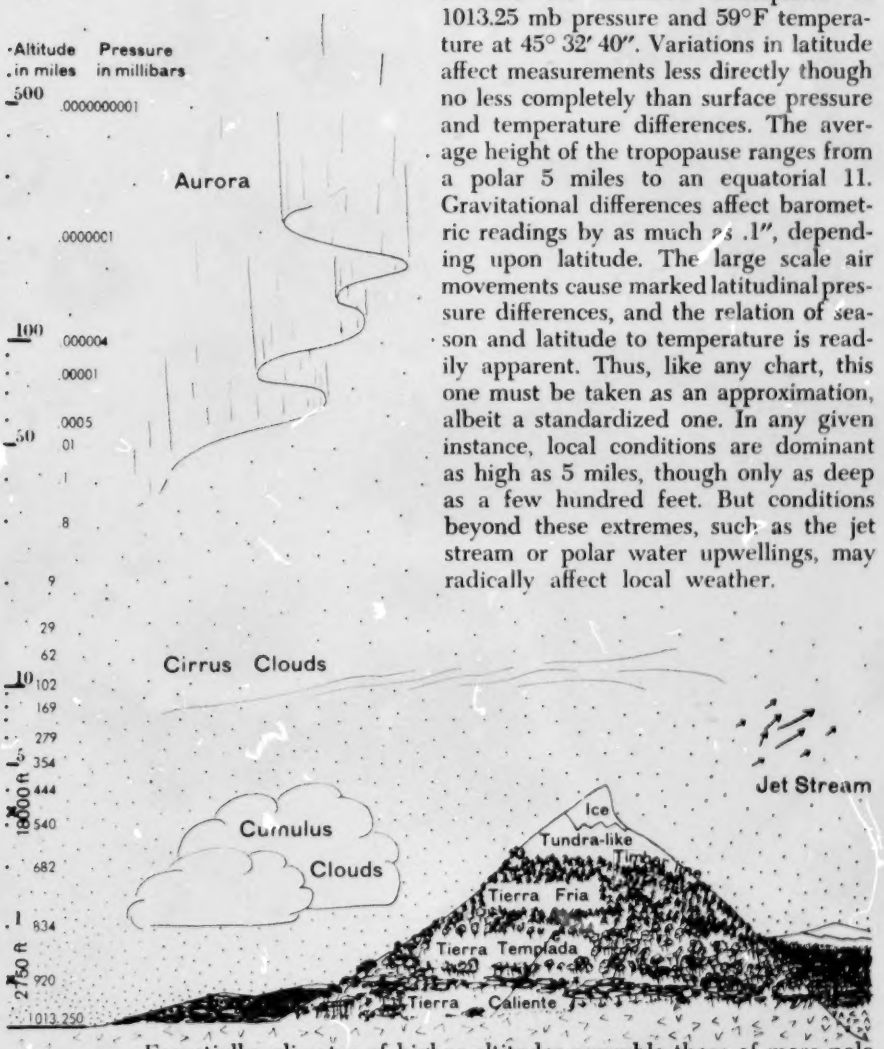

Ob-Irtysh 3460 miles
Largest Flat Area
West Siberian Plain
over 2 million square miles
Deepest Lake
Baykal 5315
Volga
2290 miles
Largest Salt Water Lake
Caspian Sea 143550 square miles
- 92
Mt. Elbrus
18481
Dead Sea
- 1296
Mt. Everest
29 028
Largest Sea
South China Sea
1.3 million
square miles
Mariana Trench
36198
Mt. Kilimanjaro
19340
Java
Trench
25344
Lake Eyre
-39
Murray-Darling
2310 miles
Mt. Kosciusco
7316

The total irregularity of the earth's surface, from Everest's 5½ miles up to Mariana's 7 miles down, is proportionately no greater than the varnish thickness on a 16" globe. Yet the most universal variation in this life layer is that of distance from sea level. The relation of altitude and pressure is relatively simple—the pressure a mile high is ⅛ lower. Near the surface this is approximately 1" of mercury for every 900 feet. In the sea pressure increases evenly with depth at a rate of one decibar per meter or one atmosphere every 32 feet. Temperature is much less regular, decreasing at 3.6°F per 1,000 feet to the constant −69.7° of the tropopause, then increasing, decreasing, and finally increasing to a fluctuating high over 2,000° to the fringes of the atmosphere around 25,000 miles, where centrifugal motion is too great for gravity to hold. Sea surface temperatures range from 28° to 96°, but after 100 feet down they rapidly approach an average deep-sea 33°. Rising air cools at the dry adiabatic lapse rate of 5.4° per 1,000 feet until its relative humidity reaches 100%. After this the heat released by condensing moisture lowers this rate somewhat depending upon the amount of precipitation. Half the atmosphere is within 18,000 feet of sea level; half the water vapor, within 8,000 feet.

	Average	<10,000	>20,000
Land	2,750 ft.	95%	.01%
Sea	12,450 ft.	23%	.1%



Effects



The atmospheric measurements given are for the standard atmosphere of 1013.25 mb pressure and 59°F temperature at 45° 32′ 40″. Variations in latitude affect measurements less directly though no less completely than surface pressure and temperature differences. The average height of the tropopause ranges from a polar 5 miles to an equatorial 11. Gravitational differences affect barometric readings by as much as .1″, depending upon latitude. The large scale air movements cause marked latitudinal pressure differences, and the relation of season and latitude to temperature is readily apparent. Thus, like any chart, this one must be taken as an approximation, albeit a standardized one. In any given instance, local conditions are dominant as high as 5 miles, though only as deep as a few hundred feet. But conditions beyond these extremes, such as the jet stream or polar water upwellings, may radically affect local weather.

Essentially, climates of higher altitudes resemble those of more poleward latitudes, but with often greater precipitation due to orographic cooling of air masses. The mountain in the illustration gives a typical zoning for a tropical mountain:

Zone	Vegetation	F°	Similar Lat.
Ice	Permanent Snow and Ice	30°	70°-90°
Tundra	Alpine Meadow	45°	60°-80°
Fria	Coniferous Forest	60°	40°-60°
Templada	Deciduous Forest	70°	20°-40°
Caliente	Rainforest	80°	0°-20°

As one moves poleward, these zones descend, so that the Cascades start with cone forests, and the Brooks Range with mostly tundra. There is also a significant difference between north- and south-facing slopes, as well as between mountains in ranges and isolated peaks.

Climate

The variations which constitute climate may be simplified into two principal elements, temperature and precipitation, which are in turn influenced by a number of modifiers. The actual quantitative measurement of these two results in continuous scales. Thus it is the relative position of a given amount of temperature or precipitation on its scale which allows comparison. To aid this positioning, standard descriptive terminology should be used, as in the following scales.

Temperature

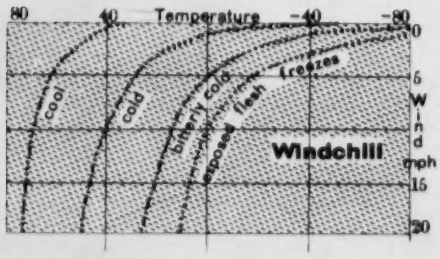
cold	< 14°	very cold
	14°–32°	cold
mild	32°–50°	cool
	50°–68°	warm
hot	68°–86°	hot
	86° <	very hot

Daily average temperature may be approximated in a number of ways. Simplest though tending high, is the mean of the daily maximum and minimum. More accurate, but also more time consuming is to compute

$$\frac{\text{Temp. at } 7\text{ am} + 2\text{ pm} + 9\text{ pm} + 9\text{ pm}}{4}$$

As a general rule, the coolest hour in a day is just before sunrise, the warmest from 2 to 3 pm, and an average around 9 am.

From a human standpoint, absolute temperature is not as important as sensible temperature, which depends also upon wind and humidity. The relation between heat and moisture is the temperature-humidity index, found by the formula $THI = 0.4\ (T_d + T_w) + 15$ where T_d is the dry-bulb thermometer reading and T_w is the wet-bulb thermometer reading.



THI *Human Comfort*

70	About 10% are uncomfortable
75	Nearly 50% are uncomfortable
80	Almost all are uncomfortable
85	Danger from stroke

Precipitation

scanty	0″–10″	arid
light	10″–20″	semiarid
moderate	20″–40″	subhumid
heavy	40″–60″	humid
very heavy	60″ <	very wet

Between 10″ and 12″ of snow equal 1″ of rain.

From an agricultural point of view, absolute precipitation is not as important as effective precipitation. This is strongly dependent upon temperature and related evaporation and transpiration rates of moisture loss. This relation is apparent in the following table.

Latitude	*15″ of rain*	*Forest needs*
low	desert	about 60″
middle	grassland	about 40″
high	open forest	about 20″

However, the distribution of rainfall is just as important as its total, as exemplified by monsoon and Mediterranean areas. Also, as a general rule, the less precipitation, the less reliable it is being more likely to come in severe but infrequent storms causing the total to fluctuate widely.

Agriculture requires precipitation to be at effective levels during the growing season. As a general rule, a 55° daily average is a guarantee of a frost-free night. Plant life becomes active when the average reaches about 40°, although temperature and growing season requirements vary widely for different crops.

Motion

SEA **AIR**

U. S. Hydrographic Office Sea State Code and U. S. Weather Bureau Beaufort Scale

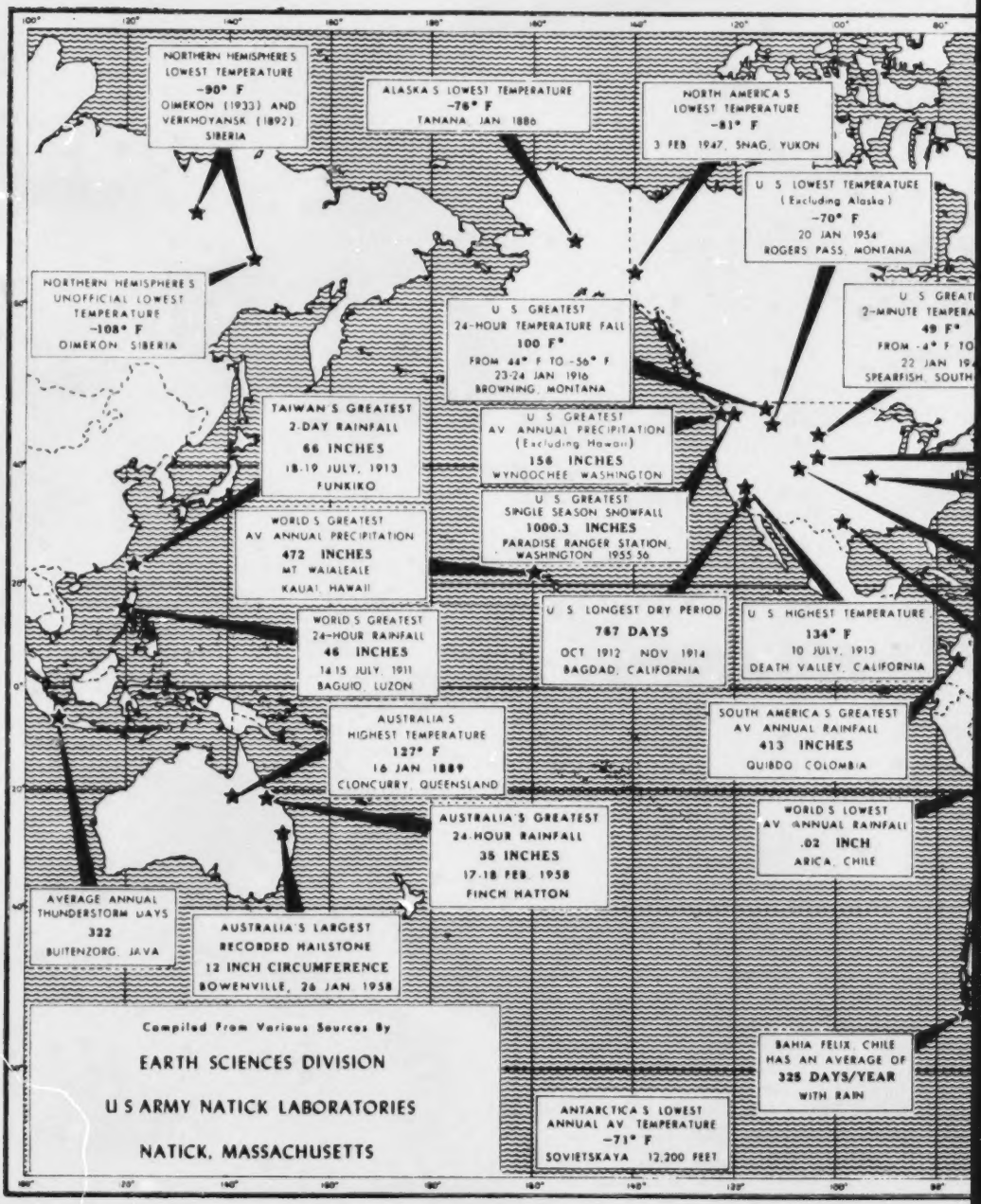
Effect Observed	Wave Height in feet	Term	Code	Code	Term	Wind Speed in mph.	Effect Observed
Sea like mirror	0	Calm	0	0	Calm	<1	Smoke rise vertically
Ripples, no crests	<1	Smooth	1	1	Light	1–3	Smoke drifts
Waves have crests	1–3	Slight	2	2		4–7	Wind felt on face
Crests begin to break	3–5	Moderate	3	3	Gentle	8–12	Light flags extended
				4	Moderate	13–18	Loose paper blown
Whitecaps become more frequent	5–8	Rough	4	5	Fresh	19–24	Small trees sway
				6	Strong	25–31	Large branches move
Foam blown in streaks	8–12	Very rough	5	7		32–38	Whole trees move
Sea begins to roll	12–20	High	6	8	Gale	39–46	Branches broken
Visibility reduced	20–40	Very high	7	9		47–54	Slight damage
Sea covered with foam	>40	Mountainous	8	10	Wholegale	55–63	Greater damage
Air filled with spray		Confused	9	11		64–72	Seldom on land
				12	Hurricane	>73	Widespread damage

EARTH

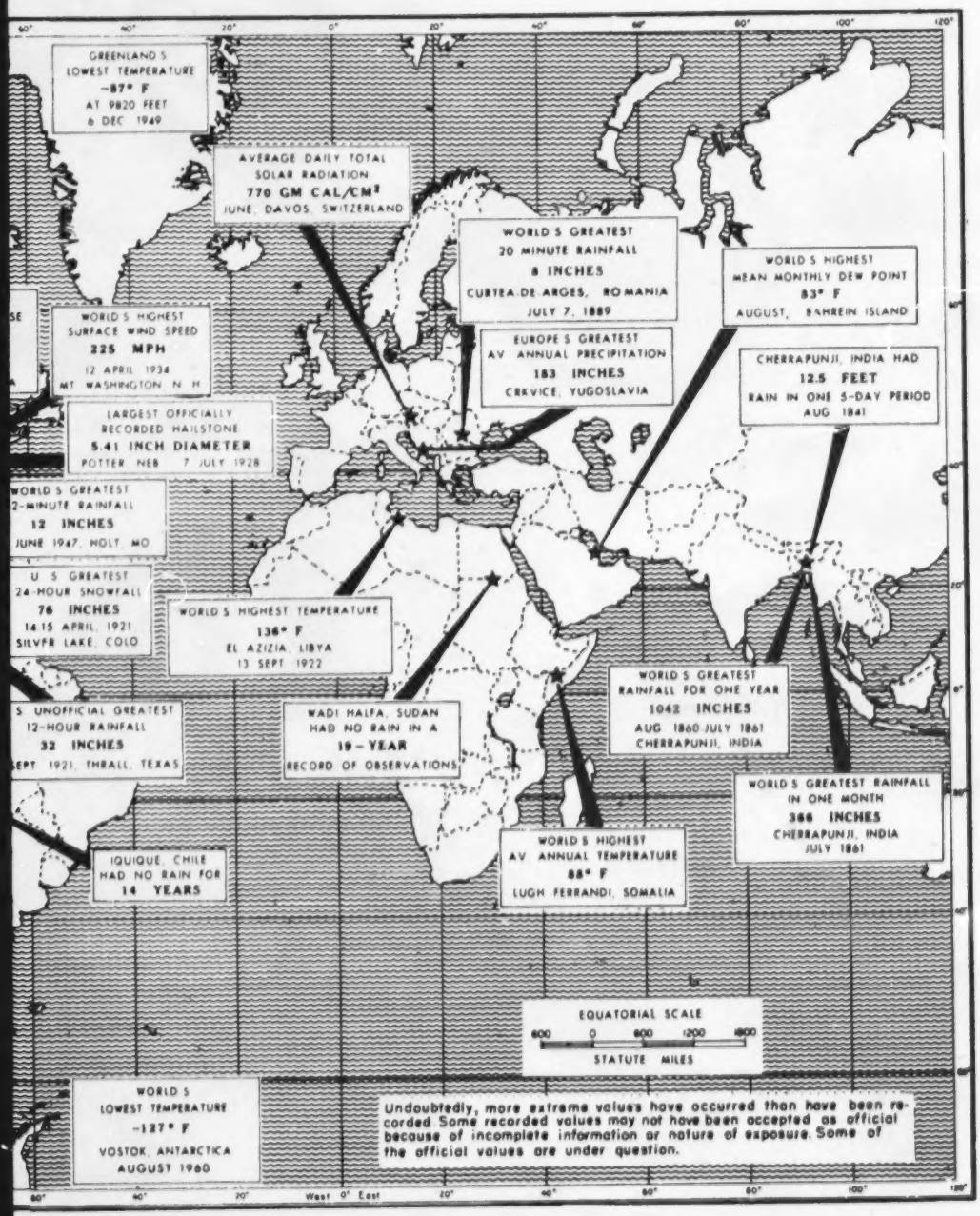
Modified Mercalli Scale of Earthquake Intensity

Code	Effect observed—damage to well-built structures
I	Not felt except under favorable circumstances
II	Felt by few—delicate suspended objects swing
III	Felt indoors—vibration like passing of truck
IV	Walls creak—felt by some outdoors
V	Windows may break—unstable objects moved
VI	Felt by all—heavy objects moved
VII	Damage slight—plaster, windows, chimneys broken
VIII	Damage considerable—monuments & chimneys fall
IX	Damage great—partial collapse, pipes broken
X	Many destroyed—ground badly cracked, land slides
XI	Most destroyed—objects thrown upward into air

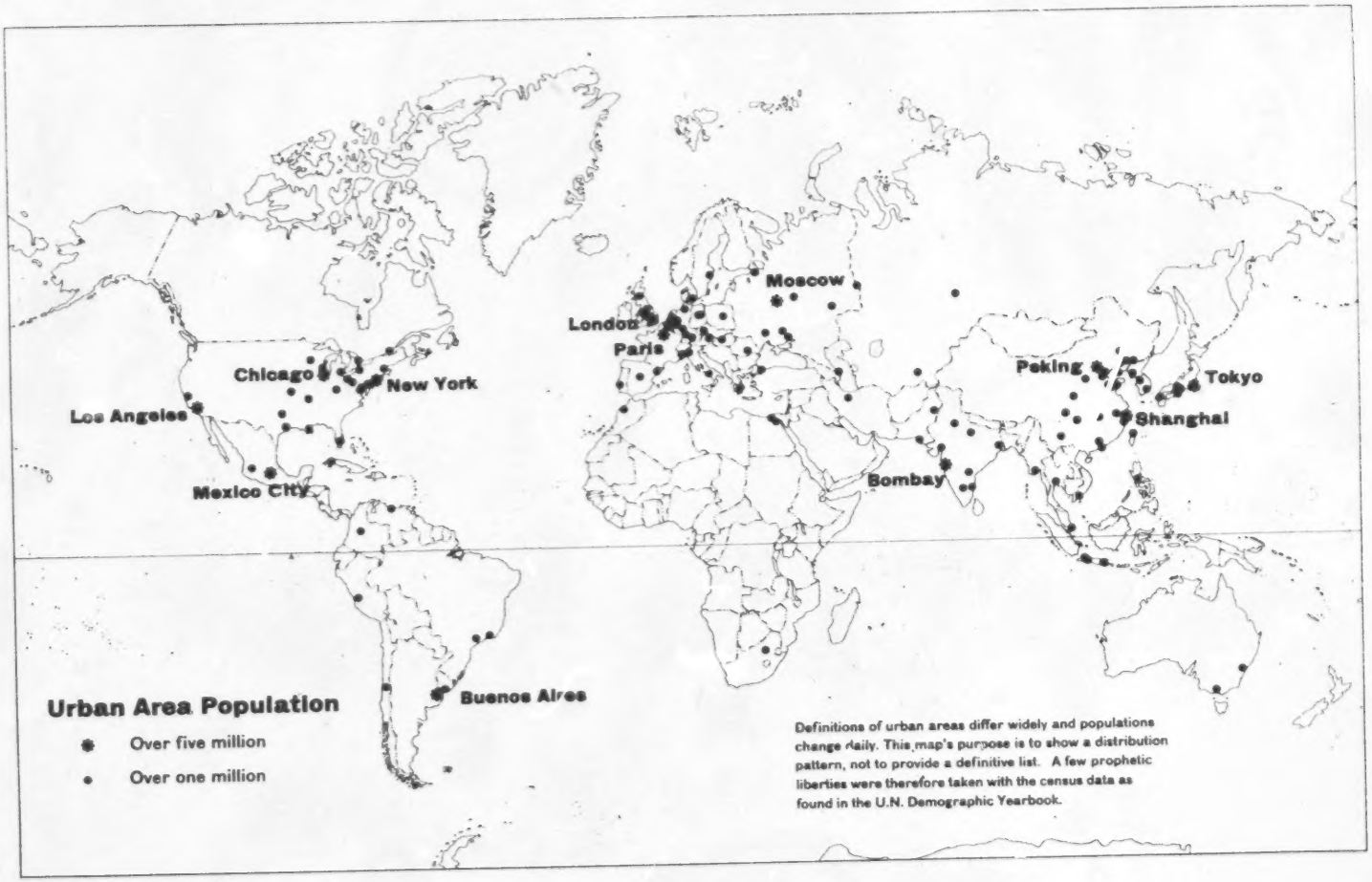
Like all quantified data, the numerical expression of motion has value only in a relative sense. Thus the establishment of standard codes aids in comparison. The fact that these codes evolved from custom rather than precise scientific measurements does not prevent them from being effective aids to standard comparison. Translation from one to another, though, is made more difficult by their independent development. Wind and wave are directly related, as shown by their corresponding codes. Wave, or sea, is the result of local atmospheric conditions; swell, or current, is produced by large scale air movements. Tidal movements and seismic disturbances superimpose their variations on the overall current pattern.


NORTHERN HEMISPHERE'S LOWEST TEMPERATURE
−90° F
OIMEKON (1933) AND VERKHOYANSK (1892) SIBERIA
ALASKA'S LOWEST TEMPERATURE
−76° F
TANANA, JAN. 1886
NORTH AMERICA'S LOWEST TEMPERATURE
−81° F
3 FEB. 1947, SNAG, YUKON
U. S. LOWEST TEMPERATURE (Excluding Alaska)
−70° F
20 JAN. 1954
ROGERS PASS, MONTANA
NORTHERN HEMISPHERE'S UNOFFICIAL LOWEST TEMPERATURE
−108° F
OIMEKON, SIBERIA
U. S. GREATEST 24-HOUR TEMPERATURE FALL
100 F°
FROM 44° F TO −56° F
23-24 JAN. 1916
BROWNING, MONTANA
U. S. GREATEST 2-MINUTE TEMPERA
49 F°
FROM -4° F TO
22 JAN. 19
SPEARFISH, SOUTH
TAIWAN'S GREATEST 2-DAY RAINFALL
66 INCHES
18-19 JULY, 1913
FUNKIKO
U. S. GREATEST AV. ANNUAL PRECIPITATION (Excluding Hawaii)
156 INCHES
WYNOOCHEE, WASHINGTON
U. S. GREATEST SINGLE SEASON SNOWFALL
1000.3 INCHES
PARADISE RANGER STATION, WASHINGTON 1955-56
WORLD'S GREATEST AV. ANNUAL PRECIPITATION
472 INCHES
MT. WAIALEALE
KAUAI, HAWAII
U. S. LONGEST DRY PERIOD
767 DAYS
OCT. 1912 - NOV. 1914
BAGDAD, CALIFORNIA
U. S. HIGHEST TEMPERATURE
134° F
10 JULY, 1913
DEATH VALLEY, CALIFORNIA
WORLD'S GREATEST 24-HOUR RAINFALL
46 INCHES
14-15 JULY, 1911
BAGUIO, LUZON
AUSTRALIA'S HIGHEST TEMPERATURE
127° F
16 JAN. 1889
CLONCURRY, QUEENSLAND
SOUTH AMERICA'S GREATEST AV. ANNUAL RAINFALL
413 INCHES
QUIBDO, COLOMBIA
AUSTRALIA'S GREATEST 24-HOUR RAINFALL
35 INCHES
17-18 FEB. 1958
FINCH HATTON
WORLD'S LOWEST AV. ANNUAL RAINFALL
.02 INCH
ARICA, CHILE
AVERAGE ANNUAL THUNDERSTORM DAYS
322
BUITENZORG, JAVA
AUSTRALIA'S LARGEST RECORDED HAILSTONE
12 INCH CIRCUMFERENCE
BOWENVILLE, 26 JAN. 1958
Compiled From Various Sources By
EARTH SCIENCES DIVISION
U S ARMY NATICK LABORATORIES
NATICK, MASSACHUSETTS
BAHIA FELIX, CHILE HAS AN AVERAGE OF 325 DAYS/YEAR WITH RAIN
ANTARCTICA'S LOWEST ANNUAL AV. TEMPERATURE
−71° F
SOVIETSKAYA 12,200 FEET

Extremes

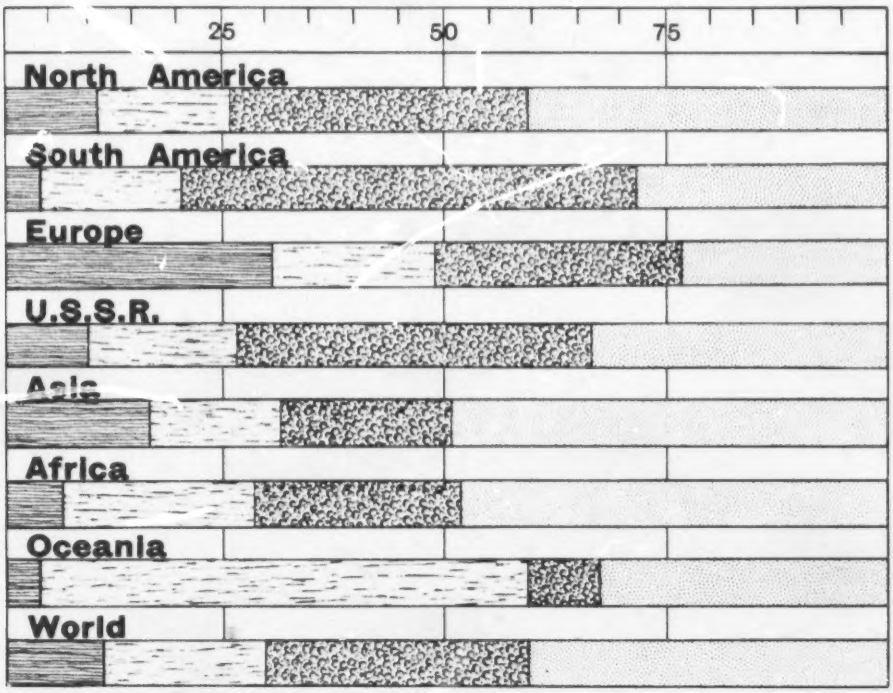

GREENLAND'S LOWEST TEMPERATURE
−87° F
AT 9820 FEET
6 DEC 1949
AVERAGE DAILY TOTAL SOLAR RADIATION
770 GM CAL/CM²
JUNE, DAVOS, SWITZERLAND
WORLD'S GREATEST 20 MINUTE RAINFALL
8 INCHES
CURTEA-DE-ARGES, ROMANIA
JULY 7, 1889
WORLD'S HIGHEST MEAN MONTHLY DEW POINT
83° F
AUGUST, BAHREIN ISLAND
WORLD'S HIGHEST SURFACE WIND SPEED
225 MPH
12 APRIL 1934
MT WASHINGTON N H
EUROPE'S GREATEST AV ANNUAL PRECIPITATION
183 INCHES
CRKVICE, YUGOSLAVIA
CHERRAPUNJI, INDIA HAD
12.5 FEET
RAIN IN ONE 5-DAY PERIOD
AUG 1841
LARGEST OFFICIALLY RECORDED HAILSTONE
5.41 INCH DIAMETER
POTTER NEB 7 JULY 1928
WORLD'S GREATEST 2-MINUTE RAINFALL
12 INCHES
JUNE 1947, HOLT MO
U S GREATEST 24-HOUR SNOWFALL
76 INCHES
14-15 APRIL 1921
SILVER LAKE, COLO
WORLD'S HIGHEST TEMPERATURE
136° F
EL AZIZIA, LIBYA
13 SEPT 1922
WORLD'S GREATEST RAINFALL FOR ONE YEAR
1042 INCHES
AUG 1860-JULY 1861
CHERRAPUNJI, INDIA
S UNOFFICIAL GREATEST 12-HOUR RAINFALL
32 INCHES
SEPT 1921, THRALL, TEXAS
WADI HALFA, SUDAN
HAD NO RAIN IN A
19-YEAR
RECORD OF OBSERVATIONS
WORLD'S GREATEST RAINFALL IN ONE MONTH
366 INCHES
CHERRAPUNJI, INDIA
JULY 1861
IQUIQUE, CHILE
HAD NO RAIN FOR
14 YEARS
WORLD'S HIGHEST AV ANNUAL TEMPERATURE
88° F
LUGH FERRANDI, SOMALIA
EQUATORIAL SCALE
600 0 600 1200 1800
STATUTE MILES
WORLD'S LOWEST TEMPERATURE
−127° F
VOSTOK, ANTARCTICA
AUGUST 1960
Undoubtedly, more extreme values have occurred than have been recorded. Some recorded values may not have been accepted as official because of incomplete information or nature of exposure. Some of the official values are under question.
West 0° East

Environmental Limitations
Too cold
Less than three months growing season
Too dry
Less than ten inches annual rainfall
Too high and steep
Over 3000 feet with great local relief
Because of severe scale limitations, this map is highly generalized. It shows environmental limitations, but when faced by population pressure and land shortage, man has often had to overcome these limitations to survive.

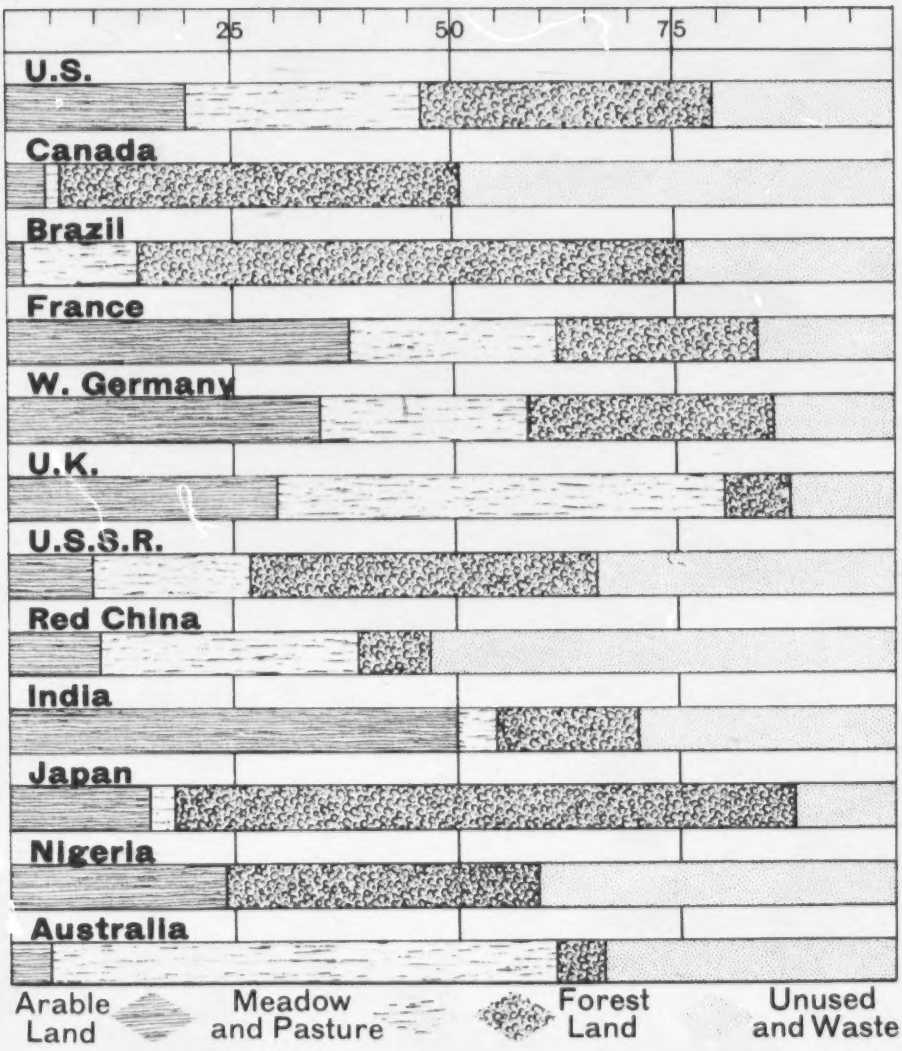

Moscow
London
Paris
Chicago
New York
Los Angeles
Mexico City
Peking
Tokyo
Shanghai
Bombay
Buenos Aires
Urban Area Population
Over five million
Over one million
Definitions of urban areas differ widely and populations change daily. This map's purpose is to show a distribution pattern, not to provide a definitive list. A few prophetic liberties were therefore taken with the census data as found in the U.N. Demographic Yearbook.

Land

Central to the subject of man-land relationships is the obvious fact that some forms of land are more usable than others. The most strenuous limitations placed by nature on land usability, the climatic and slope factors of the preceding pages, are literally yes-no alternatives. Further refinements of the concept of land usability imply greater freedom of choice for man, yet growing season, rainfall, soil, vegetation, terrain, and occupance still exert a potent influence. A clearer picture of a region's land in terms of its human value is afforded by the breakdown given below. While the simple percentages are of some value, analysis of other data in the light of this is especially meaningful. Comparison of the population density of a nation with its percentage of arable land gives its productive farm land density. Likewise the percentage of forest land compared with total area and population will yield the amount of forest available per person. Equally important as the percentage is the distribution. Millions of square miles of Siberian forest are punished by inaccessibility, while most of Egypt crowds in a river valley. It must also be remembered that any breaking down of a complex reality to a few divisions for analysis inevitably results in a somewhat distorted picture. In this case, the Ukranian chernozem region and rocky New England are apparently the same, while metropolitan London and central Greenland are classed as agriculturally unusable. Drawing an exact line through any variable area, whether climatic, population, soil, or land use, is an impossibility. Only an indication as to the distribution can be justified, becoming less precise as the subject becomes more complex. Thus a rainfall isoline is more accurate than a general farming-grazing boundary. In the present case, lines such as those between savannah grass and open forest, between private gardens and truck farms, between dairy hay and range grass, are especially difficult to draw. As in the case of severe limitations, population pressure has often forced man to press less desirable agricultural land into service. Often these marginal lands have periods of favorability, in which rainfall is heavier, temperatures better, or soils fresh and are thus exploitable. When these are followed by the drier, or colder or leached phases of the cycle, the consequences are often disastrous, as in our Dust Bowl or the overrun tropical gardens.



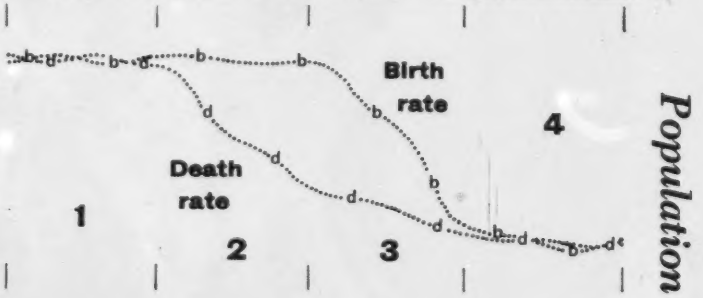
Usability



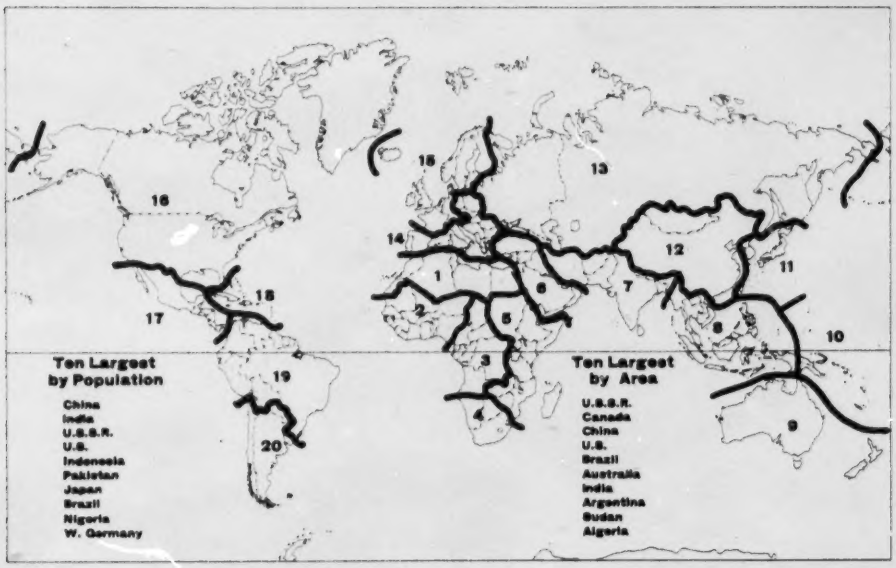
The breakdown above is for twelve selected nations chosen to include some of the largest nations and several to represent different stages of economic development and variation in significant population characteristics. For the next few pages, these nations will be identified statistically, in detail, not only to render a picture of them, but also to provide opportunities for practice in country analysis. It is usually more meaningful to note correlations of different kinds of data than to concentrate on them singly. Viewing a subject from different angles tends to improve the perspective. With regard to correlations, a word of warning is probably in order—one must be careful to handle causal relationships with caution. For example, to assume that per acre yield necessarily increases with farm mechanization is obviously wrong. Let the data speak for themselves.

	Population (millions at latest census)	Population 1963 est. (millions)	Area (in million sq. miles)	Density pop./sq. mi.	% Increase	Birth Rate (#/1000 pop.)	Death Rate (#/1000 pop.)	Infant (#/1000 live births)	Life Expectancy (at birth) Male	Female
Australia	10.5 ('61)	10.9	2.97	2.6	2.1	21.6	8.7	19.5	67	73
Brazil	71.0 ('60)	76.4	3.29	23	3.1	43–47	11–16	170	39	45
Canada	18.2 ('61)	18.9	3.85	5	2.0	23.8	7.6	26.3	68	74
China	582.6 ('53)	[686.4 ('60)]	3.69	(200)	—	34	11	—	—	—
France	46.5 ('62)	47.9	.21	225	1.3	18.1	10.6	23.4	67	74
Germany (West)	54.0 ('61)	55.4	.09	581	1.3	18.2	11.0	27.0	67	72
India	435.5 ('61)	460.5	1.18	391	2.3	41.7	22.8	139	42	41
Japan	93.4 ('60)	95.9	.14	672	.9	17.7	6.9	20.4	71	73
Nigeria	55.6 ('63)	55.6	.35	155	—	53–57 (est.)	—	—	—	—
USSR	208.8 ('59)	224.8	8.62	26	1.7	21.2	7.2	30.9	65	73
UK	52.7 ('61)	53.8	.09	572	.7	18.7	11.3	20.7	68	74
US	179.3 ('60)	189.4	3.61	52	1.6	21.2	9.4	25.8	67	73
World	—	3,160.00	52.4	60	1.9	—	—	—	—	—

Demographic experts customarily speak of four phases of population evolution: 1) stable high birth and death rates, characteristic of primitive societies; 2) falling death rate, a result of increased medical knowledge and corresponding lengthened life expectancy; 3) a falling birth rate as population pressure encourages birth control and smaller families; 4) stable low birth and death rates, characteristic of the technologic civilizations.



Characteristics



Map Guide Number	United Nations	Population in millions	Annual % of increase	Area in million square miles	Density, No. per sq. mile	Population (millions in 2000 A.D.)
1	N. Africa	72	2.9	3.28	22	228
2	W. Africa	93	2.6	2.39	39	318
3	Middle Africa	30	2.3	2.55	12	64
4	S. Africa	19	1.8	1.03	18	58
5	E. Africa	80	2.2	2.43	33	193
6	S. W. Asia	63	2.2	1.78	35	193
7	Middle S. Asia	621	2.3	2.62	237	1,709
8	S. E. Asia	236	2.5	1.74	136	697
9	Australia	13.5	2.1	3.08	4	24
10	Islands	3.3	3.4	.22	15	9
11	Other E. Asia	146	1.7	.24	603	293
12	Mainland E. Asia	682	1.4	4.29	159	1,509
13	U.S.S.R.	225	1.7	8.65	26	402
14	S. & E. Europe	219	.8	.89	246	301
15	N. & W. Europe	218	1.1	1.01	215	270
16	N. America	208	1.5	9.31	22	388
17	Middle Am.	51	.97	.97	53	195
18	Caribbean Am.	22	3.2	.09	242	62
19	Tropical S. Am.	51	3.2	5.28	23	431
20	Temperate S. Am.	35	2.0	1.59	22	68

Production and Consumption of Selected Industrial Commodities

(Figures are thousand metric tons)

	BAUXITE	ALUMI-NUM	IRON		STEEL		SALT	CEMENT	H_2SO_4	SUGAR
			Ore	Pig	Prod.	Cons.				
Australia	360	41.9	3,614	3,682	4,644	4,245	(560)	3,119	1,269	1,706
Brazil	(200)	20.1	(7,500)	2,375	2,812	3,393	(1,400)	5,154	(200)	3,037
Canada	—	652.6	15,036	5,496	7,430	7,143	3,387	6,363	1,725	151
China	(400)	(100)	—	17,000	12,000	12,299	10,500	9,000	(2,000)	1,300
France	2,005	298.4	18,812	14,504	17,557	15,602	3,503	18,060	2,394	1,998
Germany	4	208.8	3,124	22,909	31,597	27,276	6,181	29,217	3,316	2,037
India	565	53.4	12,464	6,740	5,971	7,280	4,539	9,355	568	2,502
Japan	—	223.9	1,363	20,434	31,501	24,726	747	29,948	4,991	375
Nigeria	—	—	—	—	—	213	—	527	—	—
USSR	(4,300)	(960)	79,460	58,700	80,198	77,347	9,560	61,018	6,887	5,978
UK	—	31.1	4,091	14,825	22,881	19,899	6,495	14,059	2,927	784
US	1,860	2,097.9	41,542	66,998	99,120	102,309	27,800	61,609	18,993	3,416
World	31,420	5,520	250,600	281,000	386,600	—	—	368,000	—	51,899

The industrial development of a nation consists of the quantity and degree of its transformation of raw materials into refined products and then into finished articles. The final state varies with the consumer and trade demands of the individual country; therefore to get a valid standard measure for comparison, the production of successive stages of refinement is a better criterion.

Energy

	Coal Production (million tons)	Oil Production (million tons)	Energy Prod. (million metric tons of coal equivalent)	Energy Consumption (million metric tons of coal equivalent)	Energy Consumption Per Capita (kg. of coal)	Coke (million tons)
Australia	25.3	—	32.3	46.0	4,213	2.9
Brazil	1.6	4.7	11.6	28.7	377	.7
Canada	7.9	35.1	109.5	124.1	6,553	3.9
China	(420.0)	(5.5)	298.3	300.0	392	15.0
France	47.8	2.5	64.8	133.5	2,788	13.4
Germany	142.8	7.4	189.1	237.4	4,121	41.9
India	66.0	1.7	70.0	78.4	170	7.4
Japan	52.1	.8	64.2	146.9	1,532	11.3
Nigeria	.6	3.8	5.5	1.8	31	—
USSR	395.1	206.1	807.1	726.8	3,234	63.9
UK	198.9	.1	200.5	274.8	5,090	15.7
US	430.5	372.0	1,516.5	1,611.1	8,507	49.2
World	1,929.0	1,303.5	4,792.7	4,697.2	1,463	—

The chief difference between a technologically developed economy and an underdeveloped nation lies in the energy which the individual has at his disposal. The command of energy resources beyond human or animal muscle is the prerequisite for industrial development and the gateway to a higher standard of living. The problem becomes critical when one realizes that precisely those nations with energy deficiencies are the ones most tightly pressed by exploding populations, high man/land ratios, and primitive agricultural methods. Increasing the energy available to people in these lands acts first to lower the death rate, thus compounding the problem.

Relative Status of Culture Regions

	Population	Energy Consumed	"Energy Slaves" per Capita		Population	Energy Consumed	"Energy Slaves" per Capita
Anglo-America	7%	32%	85	Latin America	7%	5%	12
Western Europe	11%	18%	31	South & East Asia	52%	18%	7
Soviet Bloc	10%	21%	36	Dry Moslem World	5%	3%	9
Oceania	1%	1%	34	Subsaharan Africa	7%	2%	6
Industrial Regions	29%	72%		Non-Industrial Regions	71%	28%	

Other Economic and Social Measures

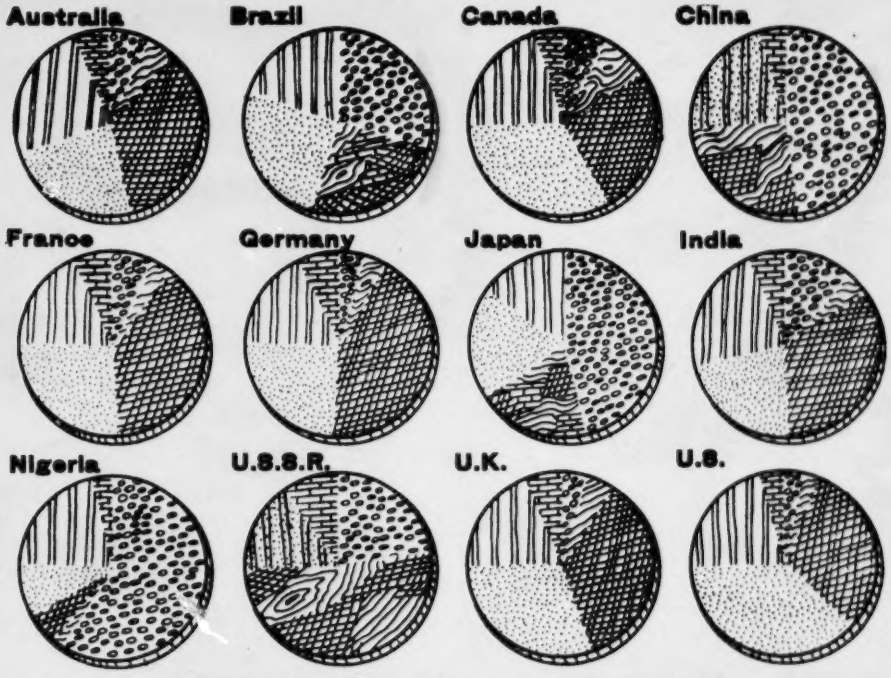
Country	AGRICULTURE		HOUSING		TRANSPORTATION		LITERACY		MEDICINE	
	Percent of workers	Farmers per tractors	Rooms per dwelling	Persons per room	Billion ton-miles railfreight	Persons per auto	Fraction illiterate (*<5%)	Newspaper copies per 1,000 pop.	Persons per physician	Daily food in calories per person
Australia	11	1.6	5.1	0.7	9.3	4	*	375	880	3,140
Brazil	60	16	4.1	1.3	9.5	88	1/2	54	2,500	2,860
Canada	11	1.3	5.3	0.7	67	4	*	223	860	3,060
China	(85)	(4,000)	—	—	164	(20,000)	1/2	19	—	—
France	20	4.8	3.1	1.0	39	6	*	257	910	2,940
Germany	12	3.2	4.1	0.9	37	8	*	315	670	2,960
India	70	4,200	2.0	2.6	57	1,300	4/5	.3	5,800	2,000
Japan	33	30,000	3.6	1.4	36	78	*	420	900	2,280
Nigeria	(70)	(75,000)	1.4	3.0	1.6	1,300	4/5	10	27,000	—
USSR	39	29	3.3	1.5	1,085	300	1/10	181	500	—
UK	6	2.7	4.8	0.7	17	7	*	490	960	3,000
US	7	1.2	4.9	0.7	567	3	*	311	760	3,100

There are many ways to take the pulse of a nation's economy. The problem is usually not one of finding data, but of 1) selecting meaningful indices, ones which give valid criteria for measurement; 2) verifying and standardizing the data, for the comparison of figures with different bases will always give a false picture; 3) expressing the data in a meaningful way. Thus in this table the basic information was taken from United Nations Yearbooks, which aim at standard measures across the world. In the case of agriculture, the number of farmers per tractor seemed to give a better overall picture of agriculture in the country than the production of a given commodity, or the average acreage per farm. Yet it does not give a complete view; no single measure can. Even it had to be derived from a table giving the number of tractors in use and another table of the number of people engaged in agriculture. The final combination was more easily comprehended than either source. With all this care, however, the results are still far from satisfactory, with some crude estimates necessitated by the lack of precise information, and cases where even that is impossible. Since countries grow and change, data such as the above also fluctuate. Highly generalized comparison is thus the only valid use of this information.

*National Economy Measures**

Country	NATIONAL INCOME		EXCHANGE RATE	TRADE TOTALS	
	Billions of US dollars	Dollars per person	National currency per US dollar	In billions of US dollars	
				Imports	Exports
Australia	20	1,733	.4501 (£ A)	2.40	2.39
Brazil	2	196	1200 (cruzeiro)	1.49	1.41
Canada	40	2,100	1.081 (dollar)	6.05	6.46
China	80	117	2.00 (yuan)	(.140)	(.104)
France	80	1,658	4.9 (franc)	8.78	8.13
Germany	90	1,635	3.975 (D.M.)	13.02	14.62
India	40	86	4.795 (rupee)	2.3	1.60
Japan	60	626	363.0 (yen)	6.74	5.45
Nigeria	50	93	.3571 (£)	5.81	5.31
USSR	280	1,202	.90 (ruble)	7.06	7.27
UK	85	1,564	.3583 (£)	13.47	11.85
US	600	3,083	1	.21	24.39

* These figures are an approximation. They change yearly.



Production

Farm

(Field)

Wheat

USSR	1/4
US	1/7
China	1/8
Canada	1/12

Rice

China	1/3
India	1/5
Pakistan	1/15
Japan	1/15

Flax

US	1/4
Argen.	2/9
Canada	1/6

Soybeans

US	3/5
China	1/3

Corn

US	2/5
USSR	1/10
China	1/10

Potatoes

USSR	3/10
Poland	1/6
W. Ger.	1/10

Groundnuts

India	2/5
China	1/8
Nigeria	1/10

Tobacco

US	1/4
India	1/10
Brazil	1/20

Cotton Fiber

US	1/3
China	1/4
USSR	1/6

Jute

Pakistan	1/2
India	2/3

(Range)

Cattle

India	1/6
US	1/9
USSR	1/11
Brazil	1/12

Milk

USSR	1/5
US	1/6
France	1/12

Sheep

Austral.	1/6
USSR	1/8
China	1/15
N.Z.	1/20

Wool

Austral.	1/3
USSR	1/7
N.Z.	1/9

Horses

USSR	1/7
Brazil	1/8
China	1/9

Pigs

China	1/3
USSR	1/8
US	1/10

Meat

US	1/5
USSR	1/7
W. Ger., Fr.	1/20

Rye

USSR	1/2
Poland	1/5
E. Ger.	1/10

Oats

US	2/7
Canada	1/7
USSR	1/9

Forest

(or tree crop)

Palm Oil

Nigeria	1/3
Congo	1/5
Indon.	1/8

Coffee

Brazil	3/8
Colombia	1/9
Iv. Coast	1/15

Tea

India	2/5
Ceylon	1/4

Rubber

Malaysia	2/5
Indon.	1/3
Thailand	1/12

Oranges

US	3/10
Spain	1/8
Japan	1/12

Cacao

Ghana	1/3
Nigeria	1/6
Brazil	1/9

Round Wood

USSR	1/5
US	1/6
Brazil	1/12

Oceans

Fishing

Peru	1/7
Japan	1/7
China	1/9
USSR	1/12

Whaling

Japan	1/4
USSR	1/6
Norway	1/10

Mine

(Open Pit, Shaft, and Well)

Iron

USSR	3/10
US	1/7
China	1/8

Copper

US	2/9
Chile	1/7
[illegible]	1/7
Zambia	1/8

Nickel

Canada	5/9
USSR	1/4
New Calendonia	1/9

Zinc

US	1/8
Canada	1/9
USSR	1/9

Bauxite

Jamaica	2/9
USSR	1/8
Surinam	1/9

Lead

Austral.	1/6
USSR	1/8
US	1/12

Tungsten

China	2/5
USSR	1/5
2 Koreas	1/6

Molybdenum

US	3/4
USSR	1/8

Platinum Group

USSR	1/2
S. Africa	1/4
Canada	1/7

Tin

Malaysia	1/3
China	1/7
Bolivia	1/8

Coal

US	2/9
China	2/9
USSR	1/5

Lignite

E. Ger.	1/3
USSR	1/5
W. Ger.	1/7

Petroleum

US	1/4
USSR	1/6
Venez.	1/9
Kuwait	1/12

Salt

US	2/7
China	1/9
USSR	1/10

Diamonds

Congo	1/2
S. Africa	1/7
Ghana	1/10

Sulfur

US	2/7
Japan	1/10
Mexico, France	1/12

Phosphate

US	2/5
USSR	1/5
Morocco	1/6

Gold

S. Africa	2/3
USSR	1/10

Chromium

USSR	1/2
S. Africa	1/8
Albania, Philipp.	1/10

Cobalt

Congo	1/2
Zambia	1/5

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Rankings

Factory

(Organic)

Margarine

US	1/5
USSR	1/7
W. Ger.	1/7

Fish Meals

Peru	2/5
Japan	
US	1/9

Wine

France	1/5
Italy	1/5
Spain	1/10

Beer

US	1/4
W. Ger.	1/8
UK	1/10

Tobacco Prods.

US	1/4
USSR	1/8
Japan	1/12

Lumber

USSR	1/3
US	1/4
Japan	1/15

Pulp-Mech.

Canada	1/4
US	1/5
Finland	1/12

Pulp-Chem.

US	1/2
Canada	1/8
Sweden	1/10

Sugar

USSR	1/9
Cuba	1/13
US	1/15

Olive Oil

Spain	1/3
Italy	2/7
Greece	1/9

(Inorganic)

Aluminum

US	1/2
USSR	1/6
Canada	1/8

Copper

US	1/4
USSR	1/7
Zambia	1/8

Iron

US	1/4
USSR	1/5
W. Ger.	1/12

Steel

US	1/4
USSR	1/5
W. Ger.	1/12
Japan	

Zinc

US	3/10
USSR	1/8
Japan	1/12

Lead

US	1/3
USSR	1/7
Austral.	1/8

Magnesium

US	1/2
USSR	2/9
Norway	1/7

Cement

USSR	1/6
US	1/6
Japan, W. Ger.	1/12

Coke

USSR	2/9
US	1/5
W. Ger.	1/7

(Products)

Automobiles

US	1/2
W. Ger.	1/7
UK	1/10

Rayon

US	1/4
USSR	1/9
Japan	1/10

Fertilizer

US	2/7
USSR	1/11
Japan	1/11

Newsprint

Canada	2/5
US	1/8
Japan	1/14

Other Paper

US	3/8
Japan	1/14
W. Ger.	1/15

Synthetic Rubber

US	3/5
Canada	1/15

Consumption

Fertilizer

US	1/4
USSR	1/12
W. Ger., Japan	1/20

Cotton

US	1/5
USSR	1/7
China	1/8
India	1/9

Wool

UK	1/7
USSR	1/7
US	1/9

Automobiles

US	7/12
France, UK, Ger.	1/15

Electricity

US	3/8
USSR	1/7
UK	1/15
Japan	1/18
W. Ger.	1/20

Other

Ship Fleets

US	1/7
UK	1/7
Liberia	1/10
Norway	1/11

Civil. Aviation

US	5/9
UK	1/15
France	1/25

Tourists Visiting Country (number in millions)

Canada	31
Spain	11
Italy	10
Scandin.	9
France	6.5

Spinning Spindles

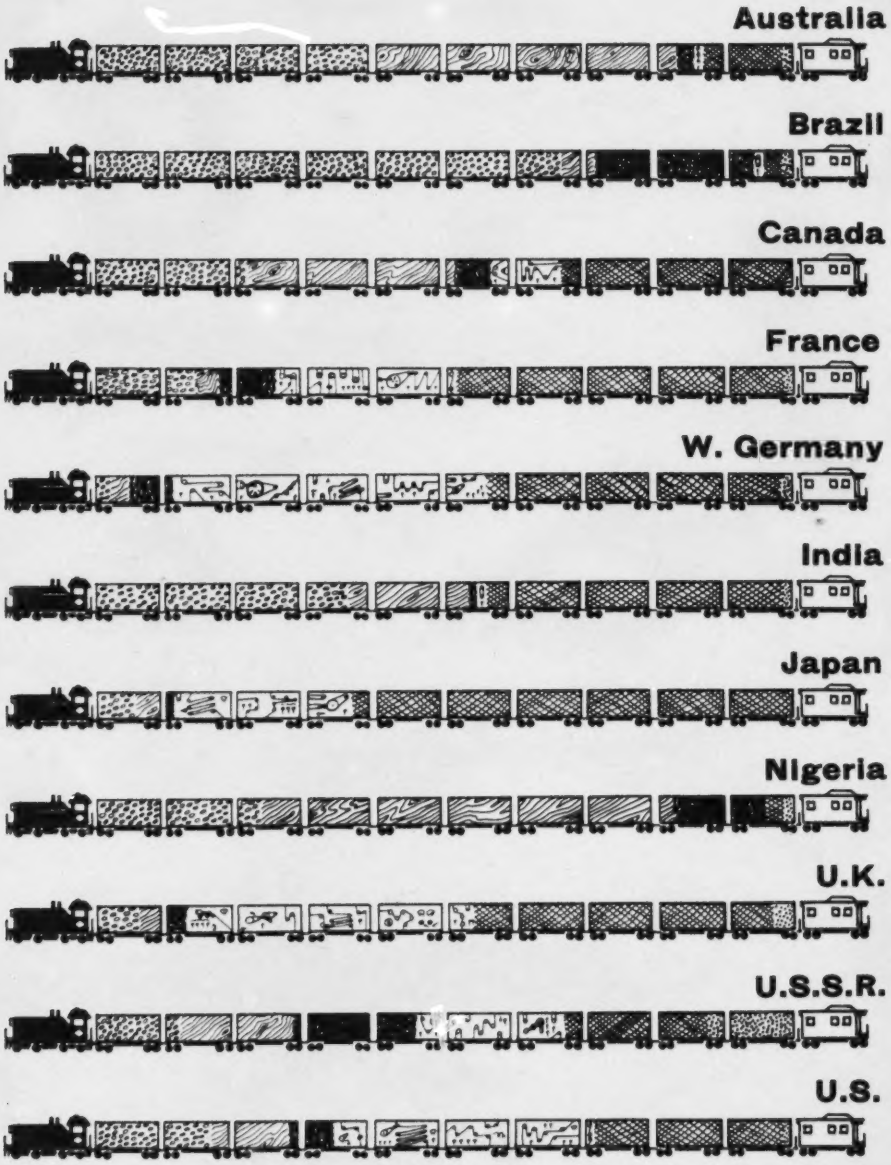
US	1/7
India	1/9
Japan	1/10

A nation's production of a given commodity is easily seen by its rank when compared with other nations. Implications can be drawn about the relative dependence or self-sufficiency of various countries in certain commodity groups. The rankings are of greater value when other factors—population, balance of trade, agricultural, mineral, or industrial self-sufficiency—are also considered. The fractions given represent averages, and are only approximate for any given year.

A few commodities are found almost exclusively within one country or region.

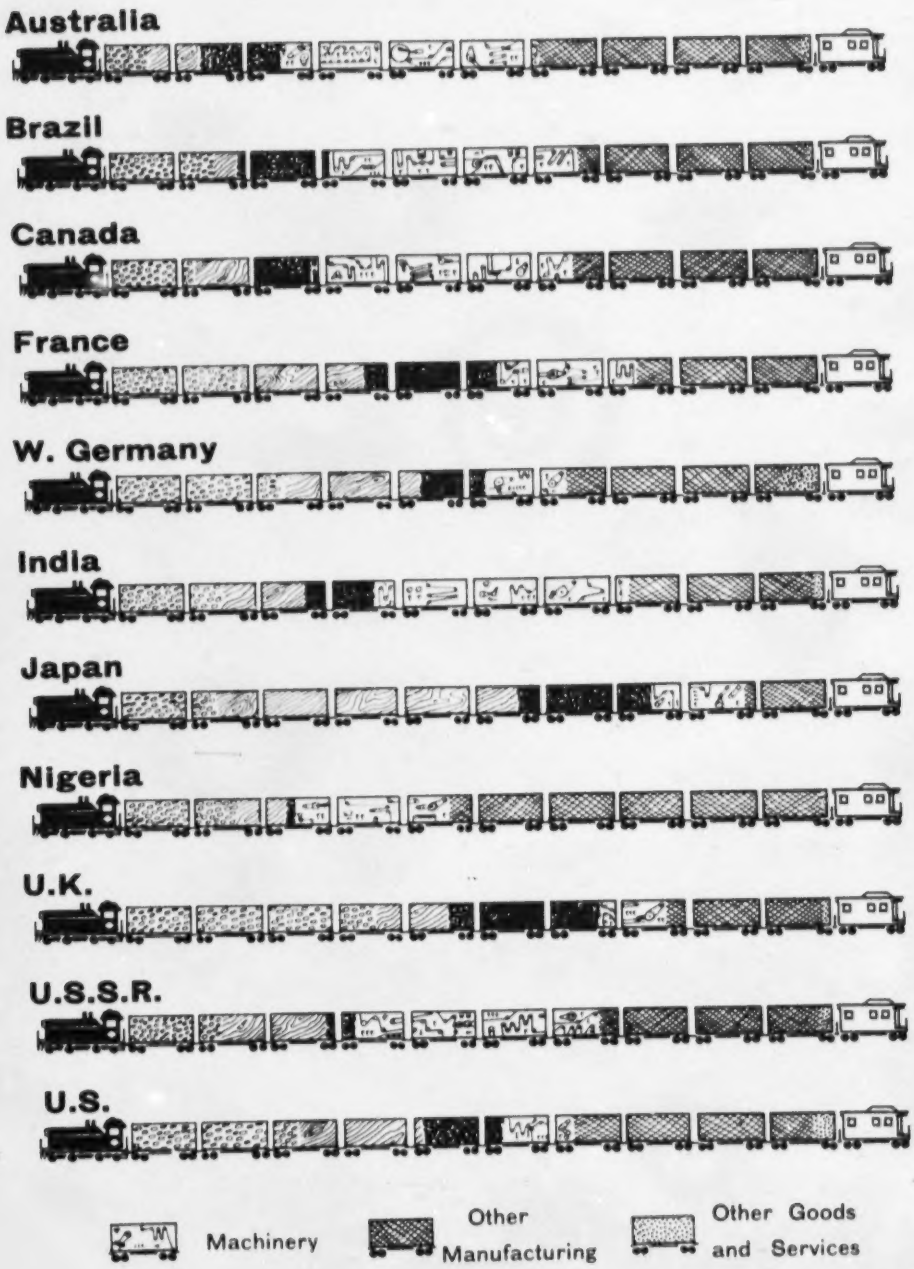
Cryolite	Greenland	100%
Columbite	Nigeria	80%
Sapphires	Thailand	60%
Quinine	Java	90%
Diamonds	Africa	97%

Exports


Australia
Brazil
Canada
France
W. Germany
India
Japan
Nigeria
U.K.
U.S.S.R.
U.S.
Food and Beverages
Raw Materials
Fuels and Lubricants

36

Imports


Australia
Brazil
Canada
France
W. Germany
India
Japan
Nigeria
U.K.
U.S.S.R.
U.S.
Machinery
Other Manufacturing
Other Goods and Services

Acknowledgments

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